Scientific Research Publishing

Open Journal of Immunology, 2024, 14, 33-45
https://www.scirp.org/journal/oji
ISSN Online: 2162-4526
ISSN Print: 2162-450X

Seroprevalence of Human Immunodeficiency Virus and Hepatitis B in Blood Donors at the N'Zérékoré Regional Blood Transfusion Centre in Guinea

Alimou Camara[1,2*], Ernest Thea[2], Ives Nyankoye Haba[2,3], Yamoussa Youla[2], Ibrahima Sory Diallo[2,4], Mariama Sadio Diallo[2,5], Djiba Kaba[2], Jacob Camara[1], Moussa Condé[1], Barré Soropogui[1,2], Kaba Kourouma[2], Thierno Mamadou Tounkara[2,6], Babacar Mbengue[7], Abdoulaye Touré[2,8], Sanaba Boumbaly[1]

[1]Virology Research Centre, Guinea Viral Haemorrhagic Fevers Laboratory, Conakry, Guinea
[2]Faculty of Health Sciences and Techniques, Gamal Abdel Nasser University, Conakry, Guinea
[3]National Blood Transfusion Centre, Ministry of Health and Public Hygiene, Conakry, Guinea
[4]Institute of Health and Childhood, Donka National Hospital, Conakry, Guinea
[5]African Centre of Excellence for the Prevention and Control of Communicable Diseases, Conakry, Guinea
[6]Department of Dermatology and Venereology, Donka University Hospital, Conakry, Guinée
[7]Immunology Laboratory, Cheikh Anta Diop University, Dakar, Senegal
[8]Centre for Research and Training in Infectious Diseases of Guinea, Conakry, Guinea
Email: *alimou.4camara@gmail.com

How to cite this paper: Camara, A., Thea, E., Haba, I.N., Youla, Y., Diallo, I.S., Diallo, M.S., Kaba, D., Camara, J., Condé, M., Soropogui, B., Kourouma, K., Tounkara, T.M., Mbengue, B., Touré, A. and Boumbaly, S. (2024) Seroprevalence of Human Immunodeficiency Virus and Hepatitis B in Blood Donors at the N'Zérékoré Regional Blood Transfusion Centre in Guinea. *Open Journal of Immunology*, **14**, 33-45.
https://doi.org/10.4236/oji.2024.142004

Received: May 1, 2024
Accepted: June 25, 2024
Published: June 28, 2024

Abstract

Blood transfusion saves lives and reduces morbidity and mortality for a large number of diseases and clinical conditions, but it is not without danger. The aim of this study was to determine the seroprevalence of HIV and hepatitis B in blood donors received at the regional Blood Transfusion Centre of N'Zérékoré (Guinea). This was a 5-year retrospective analytical study. We included records of blood donors aged 18 to 60 years admitted to the N'Zérékoré Regional Blood Transfusion Centre for blood donation from January 2016 to December 2020. We performed a descriptive analysis followed by Chi-2 or Fish-er-exact tests and the Student or Wilcoxon test, followed by multivariate logistic regression. In this study, donor age ranged from 18 - 60 years, with a pre-dominance of donors aged 25 - 34 (44.2%). Male donors were the most represented in our study (79.0% versus 21.0% female). More than half of the donors were blood group O (55.6%). We observed a seroprevalence of 3.6% for HIV, 13.4% for HBsAg and 0.2% for co-infection. In our series, age 25 - 34 (OR = 1.89 and P = 0.001) and 35 - 44 for HIV (OR = 2.01 and P = 0.001), HBsAgserostatus (OR = 3.04 and P = 0.001) and blood donation history (OR

of 3.04 and P = 0.001) were factors associated with HIV positivity (P < 0.05). In our study, HIV serostatus (OR = 3.04 and P = 0.001) and blood donation history (OR = 0.01 and P = 0.001) were factors associated with HBsAgseropositivity. We reported a high prevalence of HIV and HBsAg. Sex, serological status and blood donation history were associated factors.

Keywords

Seroprevalence, HIV, Hepatitis B, Blood Donors, N'Zérékoré, Guinea

1. Introduction

Blood transfusion saves lives and reduces morbidity and mortality for many diseases and clinical conditions, but it is not without risk [1]. Every patient who receives a blood transfusion is at risk of contracting a post-transfusion infection such as HIV, hepatitis B virus (HBV), hepatitis C virus (HCV) or syphilitic infection, due to the shortcomings of the various national blood transfusion programmes, which often have inadequate infrastructure and limited financial resources, and sometimes have unqualified staff [2]. In 2023, according to the WHO, the prevalence of blood transfusion-related infection in low-income countries was 2.00 to 6.02% for HIV, 0.5 to 1.67% for HBV and 0.60 to 1.81% for HCV [3].

In 2016, in a study of 599 donors in the Democratic Republic of the Congo (DRC), researchers found a prevalence of 8.01% for HBV and 2.67% for HIV [2]. In the same year, another group of researchers found an overall seroprevalence of 9.7% for HBV and 5.8% for HIV in 4458 donors [4]. Finally, a study carried out in Senegal in 2021 on 2613 donors showed that 10.5% were HBsAg positive, compared with 0.38% carrying HIV markers [5]. In a study of 8055 donors, researchers also found that 14.77% carried HBsAg, compared with 2.16% for HIV [6]. In Guinea, the first study available online, carried out in 2012 on 6401 blood donations to the Centre National de Transfusion Sanguine of Guinea (CNTS), revealed a seroprevalence of 14.94% for HBV and 1.63% for HIV [7]. An annual report from Guinea's CNTS reported 9.02% for hepatitis B and 3.75% for HIV [8]. In the recent literature, studies of HIV and HBV marker carriage data are incomplete in Guinea. There are no studies in the N'Zérékoré region on HIV and HBV markers in blood donors. The results of this study, the aim of which was to determine the seroprevalence of HIV and hepatitis B, as well as the factors associated with seropositivity for these pathogens in blood donors received at the N'Zérékoré regional blood transfusion centre in Guinea, are thus reported.

2. Material and Methods

2.1. Study Population

This was a retrospective cohort of blood donors who came to the N'Zérékoré Regional Blood Transfusion Centre over 5 years (January 2016 to December

2020). The study population consisted of adults aged 18 to 60 years and weighing 60 kg or more, who were either voluntary donors (the majority) or family donors (compensatory donation) in whom diagnostic tests for HIV, hepatitis, syphilis and blood grouping had been performed during the study period. We proceeded to an exhaustive sampling of all donors meeting our inclusion criteria (above), whose socio-demographic characteristics (gender, age, residence, level of education, profession...) and biological test results (blood group, HIV, HBV and Syphilis status) are well recorded in the registries and/or electronically during the five years covering the study. The sampling procedure consisted of manual counting of cases in the laboratory registers, with the agreement of the regional director of blood transfusion, using an agreed survey form. The Alere HIV-1/2 test was used to diagnose HIV, and the procedures are described below. The "Determine HIV 1 and 2" test is an immunochromatographic test for the qualitative detection of HIV-1 and HIV-2 antibodies. The sample is deposited on the deposition zone, migrates to the conjugate zone where it builds up and mixes with the colloidal selenium-Ag conjugate. This mixture continues to migrate across the solid surface to the immobilised recombinant Ag synthesised at the patient window. The appearance of a horizontal bar on the control side ensures the validity of the test. If anti-HIV Ac is present, it binds to the selenium colloid conjugate antigen and the patient window Ag forming a red line at the patient window. If not present, the selenium colloid conjugate crosses the patient window without forming a red line. The principle behind "Determine HBsAg" is similar to that for HIV [9]. The Determine results were confirmed using the Multisure test, a rapid test that detects most of the virus carriers.

MP Multisure HIV 1/2 Confirmatory Test is a qualitative immunochromatographic assay for the rapid *in vitro* detection and differentiation of antibodies to Human Immunodeficiency Virus Types 1 and 2 (HIV-1 and HIV-2) in human serum or plasma. It is intended for professional use as a supplemental test on human serum or plasma samples found to be repeatedly reactive by screening procedures. The Multisure HIV 1/2 Confirmatory Test is your Solution to Confirmatory Test in < 30 minutes.

For HBV, an *in vitro* immunochromatographic test detecting hepatitis B surface antigen (HBsAg) was used. The Centre Regional de Transfusion de N'Zérékoré is a public reference centre covering the transfusion units of seven health districts in the forest region of Guinea and located in the prefecture of N'Zérékoré (**Figure 1**). Data collection lasted 5 months and consisted of a physical and electronic document review, during which information on sociodemographic characteristics and the results of immunoserological tests included in the documents were consulted. All subjects for whom information was incomplete or could not be found were excluded from the study.

2.2. Ethical Aspects

The retrospective aspect of the study made it impossible to obtain the participants' consent. However, the data were collected anonymously and the protocol

was approved by the Scientific Committee of the Faculty of Health Sciences and Techniques of the Gamal Abdel Nasser University of Conakry (Guinea). The study was conducted in accordance with the Declaration of Helsinki.

2.3. Statistical Analysis of Data

The data was entered using a kobo collect Ver-sion1.25.1 form and stored on the kobo Toolbox server. The raw data downloaded in Excel format were analysed using R Version 4.0 software. All analyses were performed with a 5% bilateral alpha risk. A descriptive analysis was carried out, followed by Chi-2 and Student's t tests, and a multivariate logistic regression.

3. Results

3.1. Demographic Characteristics of the Study Population

Our study included 9029 blood donors, 79% (7129) of whom were male, with a sex ratio of 3.7 (Figure 1). The average age of the population was 30, with extremes ranging from 18 to 60. The 25 to 34 age group was in the majority, at 44.2%. The majority of our population lived in urban areas (74%), and the most common occupational category was farmer (19.9%), followed by manual worker (19.5%) (Table 1).

3.2. Clinical and Biological Description of the Study Population

In this study, blood typing was one of the priority activities, and the results showed that more than half the donors had blood type O (55.6%). The majority of donors (89.5%) had no previous blood donation experience (first-time donors). We observed a seroprevalence of 3.6% for HIV, 13.4% for hepatitis B (HBsAg) and 0.2% for HIV/HBV co-infection. Seropositive donors for both pathogens were predominantly in the 25 - 34 age group (49.5%) for HIV and 47.2% for HBV (P-value < 0.001) (Table 1). During the study, the prevalence of HIV/hepatitis B co-infection detected was 0.

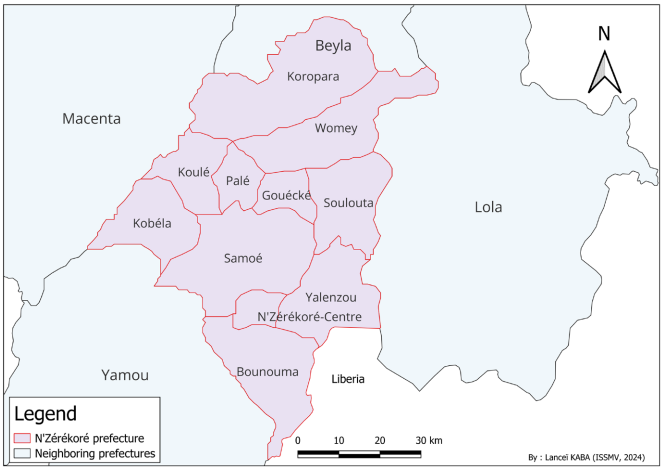

Figure 1. Geographical map of the prefecture of N'Zérékoré, location of the Regional Blood Transfusion Centre.

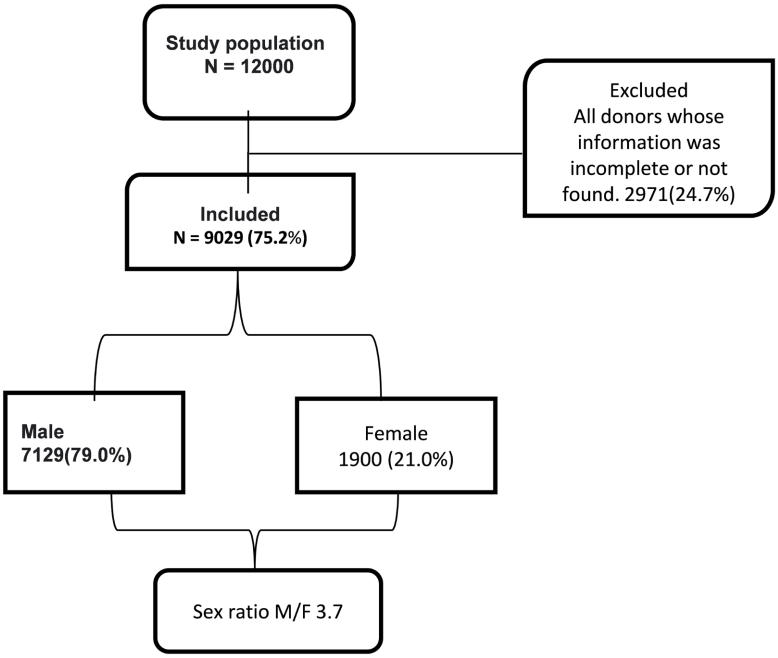

Figure 2. Donor inclusion flow chart at the N'Zérékoré Regional Blood Transfusion Centre.

Table 1. Comparative analysis of the characteristics of blood donors at the N'Zérékoré Regional Blood Transfusion Centre according to HIV serology results.

Characteristics	**Positive N = 321**	**Negative N = 8708**	**P-value**
Age in year			***<0.001***
[18, 24]	41 (12.8%)	1932 (22.2%)	
[25, 34]	159 (49.5%)	3826 (44.0%)	
[35, 44]	99 (30.8%)	2212 (25.4%)	
[45, 60]	22 (6.9%)	727 (8.4%)	
Missing	0	11	
Average age	30 (26 - 36)	30 (25 - 36)	0.2
Gender			0.044
Women	82 (25.5%)	1818 (20.9%)	
Male	239 (74.5%)	6890 (79.1%)	
Residene			0.076
Rural	97 (30.2%)	2247 (25.8%)	
Urban	224 (69.8%)	6461 (74.2%)	
Professional categories			0.001
Health agent	6 (1.9%)	188 (2.2%)	
No	10 (3.1%)	175 (2.0%)	
Farmers	73 (22.7%)	1725 (19.8%)	
Students	20 (6.2%)	905 (10.4%)	
Student	10 (3.1%)	287 (3.3%)	

Continued

Civil servant	19 (5.9%)	640 (7.3%)	
Merchands/Traders)	46 (14.3%)	1527 (17.5%)	
Mechanic	7 (2.2%)	229 (2.6%)	
Housekeeper	58 (18.1%)	1184 (13.6%)	
Military	14 (4.4%)	144 (1.7%)	
Worker	58 (18.1%)	1704 (19.6%)	
Blood Group			0.9
A	54 (16.9%)	1594 (18.3%)	
AB	11 (3.4%)	293 (3.4%)	
B	78 (24.4%)	1973 (22.7%)	
O	177 (55.3%)	4844 (55.7%)	
Missing	1	4	
History of blood donation			<0.001
First-time donor	320 (99.7%)	7759 (89.1%)	
Former donor	1 (0.0%)	949 (10.9%)	
HBsAg results			<0.001
Positive	18 (5.6%)	1191 (13.7%)	
Negative	303 (94.4%)	7 517 (86.3%)	
	n (%); Median (EI)		
	Chi-square test for independence; Student's t test		

Note: Average age 30, extremes [18 and 60]. Ratio (M/F) = 3.7.

Comparative analysis of the characteristics of blood donors at the Nzérékoré Regional Blood Transfusion Centre according to HBsAg results revealed a seroprevalence of 3.56% for HIV infection among blood donors (Table 2). The 25 to 34 age group was more represented, *i.e.* 49.5% with a value ($P < 0.001$). Males were in the majority (74.5%) and lived mainly in urban areas (69.8%). The occupational category most affected was farmers (22.7%, $P = 0.001$). Almost all donors were first-time donors (99.7%, $P < 0.001$). In this series, age, serological status and history of blood donation were factors associated with HIV positivity ($P < 0.05$) (Table 3).

Multivariate analysis of HBsAg seropositivity and socio-demographic characteristics showed a prevalence of 13.4%, predominantly in the 25 - 34 age group [0.98 (0.82; 1.16, $P < 0.001$]. Male donors were the most represented with [1.16 (0.93; 1.45), $P < 0.2$]. Donor origin was dominated by urban areas [0.96 (0.83; 1.11), $P < 0.2$] and the most common socio-professional category was mechanics (Table 4). Group B had the highest proportion [1.02 (0.85; 1.23), $P < 0.006$]. HBsAg-positive donors were first-time donors. During the study, HIV serostatus and blood donation history were factors associated with HBsAg seropositivity. The prevalence of HIV/HBV co-infection was 0.2%.

Table 2. Multivariate analysis of HIV seropositivity and blood donor characteristics.

Characteristics	**Positive**	**Negative**	**P-value**
Age in year			
[18, 24]	—	—	
[25, 34]	1.89	1.31 - 2.77	0.001
[35, 44]	2.01	1.35 - 3.05	0.001
[45, 60]	1.42	0.81 - 2.45	0.2
Sexe			
Woman	—	—	
Male	0.77	0.53 – 1.15	0.2
Residence			
Rural	—	—	
Urban	0.92	0.71 – 1.21	0.6
Professional categories			0.001
Heath Agent	—	—	
No	1.90	0.68 - 5.77	0.2
Farmers	1.31	0.60 - 3.48	0.5
Students	1.11	0.45 - 3.15	0.8
University Student	1.26	0.45 - 3.82	0.7
Civil servant	0.94	0.38 - 2.64	0.9
Merchands/Traders	0.91	0.41 - 2.41	0.8
Mechanic	1.15	0.37 - 3.70	0.8
Housekeeper	1.25	0.55 - 3.35	0.6
Military	3.38	0.29 - 9.89	0.017
Morker	1.20	0.55 - 3.19	0.7
Blood group			
A	—	—	
AB	1.07	0.52 - 1.99	0.9
B	1.18	0.83 - 1.70	0.4
O	1.09	0.80 - 1.50	0.6
AgHBs Results			
Positive	—	—	
Negative	3.04	1.94 - 5.10	<0.001
History of blood donation			
First-time donor	—	—	
Former donor	0.01	0.00 - 0.04	<0.001

OR = odds ratio, CI = confidence interval

Table 3. Comparative analysis of blood donor characteristics at the Nzérékoré Regional Blood Transfusion Centre according to HBsAg result.

characteristics	**Positive N = 1209**	**Negative N = 7820**	**P-value**
Age in year			0.001
[18, 24]	286 (23.7%)	1687 (21.6%)	
[25, 34]	570 (47.2%)	3415 (43.7%)	
[35, 44]	276 (22.8%)	2035 (26.1%)	
[45, 60]	76 (6.3%)	673 (8.6%)	
Missing	1	10	
Average age	30 (25 - 35)	30 (25 - 37)	<0.001
Gender			>0.9

Continued

Women	254 (21.0%)	1646 (21.0%)	
Male	955 (79.0%)	6174 (79.0%)	
Residence			0.011
Rural	350 (28.9%)	1994 (25.5%)	
Urban	859 (71.1%)	5826 (74.5%)	
Professional categories			0.003
Heath Agent	20 (1.7%)	174 (2.2%)	
No	24 (2.0%)	161 (2.1%)	
Farmers	284 (23.5%)	1514 (19.4%)	
Student	137 (11.3%)	788 (10.1%)	
University Student	41 (3.4%)	256 (3.3%)	
Civil Servant	75 (6.2%)	584 (7.5%)	
Merchands/Traders)	186 (15.4%)	1387 (17.7%)	
Mechanic	39 (3.2%)	197 (2.5%)	
Housekeepers	179 (14.8%)	1063 (13.6%)	
Military	22 (1.8%)	136 (1.7%)	
Worker	202 (16.7%)	1560 (19.9%)	
Blood Group			0.006
A	244 (20.2%)	1404 (18.0%)	
AB	34 (2.8%)	270 (3.5%)	
B	306 (25.4%)	1745 (22.3%)	
O	623 (51.6%)	4398 (56.3%)	
Missing	2	3	
History of blood donation			<0.001
First-time donor	1207(99.8%)	2 (0.2%)	
Former donor	948 (12.1%)	6872 (87.9%)	
AgHBs result			<0.001
Positive	18 (1.5%)	303 (3.9%)	
Negative	1191 (98.5%)	7517 (96.1%)	
	n (%); Median (EI)		<0,001
Chi-square test for independence; Student's t test			

Note: Average age 30, extremes [18 and 60]. Ratio (M/F) = 3.7.

Table 4. Multivariate analysis of HBsAg positivity and blood donor characteristics.

Characteristics	OR	95% IC	P-value
Age in year			
[18, 24]	—	—	
[25, 34]	0.98	0.82 - 1.16	0.8
[35, 44]	0.78	0.63 - 0.95	0.013
[45, 60]	0.67	0.50 - 0.89	0.006
Gender			
Women	—	—	
Male	1,16	0,93 - 1,45	0.2
Residence			
Rural	—	—	
Urban	0.96	0.83 - 1.11	0.6

Continued

Professionnal Categories			
Health Agent	—	—	
No	1.18	0.62 - 2.26	0.6
Farmers	1.43	0.89 - 2.41	0.2
Student	1.35	0.82 - 2.33	0.3
Uniersty Student	1.25	0.71 - 2.28	0.4
Civi Servant	1.13	0.67 - 1.97	0.7
Merchands/Traders)	1.07	0.67 - 1.81	0.8
Mechanic	1.49	0.83 - 2.73	0.2
Housekeeper	1.38	0.84 - 2.37	0.2
Military	1.38	0.71 - 2.70	0.3
Worker	1.06	0.66 - 1.79	>0.9
Blood Group			
A	—	—	
AB	0.71	0.47 - 1.03	0.081
B	1.02	0.85 - 1.23	0.8
O	0.84	0.71 - 0.99	0.033
HIV status			
Positive	—	—	
Negative	3.04	1.94 - 5.09	<0.001
History of blood donation			
First-time donor	—	—	
Former donors	0.01	0.00 - 0.04	<0.001
OR = odds ratio, CI = confidence interval			<0.001

4. Discussion

We conducted this study to determine the seroprevalence of HIV and hepatitis B among blood donors at the N'Zérékoré Regional Blood Transfusion Centre (**Figure 2**). The study was faced with a number of limitations, including the lack of information due to the deterioration or unavailability of certain donor registers, the illegibility of the handwriting in places (erasures, overwriting), the use of rapid diagnostic tests for the detection of serological markers, and the lack of molecular biology tests or nucleic acid detection tests which are capable of identifying infections in blood earlier and with greater sensitivity. The latter remain inaccessible and unaffordable for countries with limited resources [10]. Although they are sometimes rejected, their use is increasingly desirable, with good sensitivity, as older methods such as ELISA and Western blots have become more widely used [11]. It should be remembered that certain clinical situations, such as HIV seropositivity, can reduce the sensitivity of the rapid test [12] and also the quality of some rapid diagnostic tests, which remains to be desired and raises the issue of the use of accurate tests and safe transfusions. As for the availability of health information, this is a real problem in developing countries in general, and in Guinea in particular, because of the lack of computerisation of the system and the humidity of our landscape.

In this study, donor age ranged from 18 - 60 years, with a predominance of donors aged 25 - 34 (44.2%). Similar results have been reported by some authors in Mali, with a proportion of 40.36% of the population studied [6]. Other researchers have also reported that the 26 - 35 age group was more represented, with proportions of 57.1%, 38.4% and 36.75% respectively [13] [14] [15]. The high representation of young people in this study could be explained by the fact that they are potentially the most active and supposed to be in good health, and therefore more likely to donate blood.

Male donors were the most represented in this study (79.0%). A similar finding has been reported by other authors, in which the majority of donors were male (90.7%) [16] [17] [18]. The most represented occupational category was farmers (19.9%), followed by manual workers (19.5%). It should be remembered that agriculture is the activity practised by the majority of the Guinean population, with manual workers in second place. In the blood group determination, more than half of the donors were of blood group O (55.6%). Similar results have been reported by researchers in Gabon [19] and several other researchers in Cameroon [20] [21] [22]. In this cohort, first-time donors were more heavily represented (89.5%). This can be explained by the fact that donors are volunteers, and it is difficult to build donor loyalty. In this study, we observed a seroprevalence of 3.6% for HIV, 13.4% for HBsAg and 0.2% for HIV/HBV co-infection. In the case of HIV, this prevalence far exceeds the national figure of 1.5% according to the latest Guinea Demographic and Health Survey [23]. The prevalence of hepatitis B is similar to that reported in the literature, as Guinea is in a high-prevalence area [24]. With regard to co-infection, the proportion of 0.2% seems to be much lower than the reality in Guinea, as shown by Keita *et al.* [25]. In Sub-Saharan Africa, blood transfusion represents a potential risk of contamination. However, the high HIV seroprevalence in this study could be attributed partly to the performance of the system set up at the regional blood transfusion centre in N'Zérékoré (Guinea), and partly to the diagnostic tests used, which may result in false positives in the absence of confirmatory molecular biology tests. Although the study was unable to determine whether the infections were recent or chronic, it did help to improve transfusion safety, since the presence of just one of these immunoserological markers is sufficient to discard a blood bag and thus avoid contamination [11] [26]. The results of HBV screening in blood transfusion centres vary. They are 9.7% in Sierra Leone [27], 20.4% in Burkina Faso [28], 7.3% in Gabon [17] and 10.5% in Senegal [5]. With regard to coinfection, contrary proportions have been reported by several researchers. It was 8.49% of HBV/HIV-positive patients in Guinea [24]; 6.47% in the Central African Republic [9], in Mali in two studies it was 1.90% and 2.9% respectively [15] [16]. The association between HIV and hepatitis B can be explained by their modes of transmission and the risk factors associated with these infections, which are identical. The occupational category most affected was farmers (22.7%), P = 0.001). Contrary results

have been reported by authors in Mali 4.13% [15]. In this study, age, serological status and history of blood donation were factors associated with HIV positivity ($P < 0.05$).

5. Conclusion

The study assessed the seroprevalence and associated factors of HIV and HBsAg among blood donors at the Centre Regional de la Transfusion Sanguine de N'Zérékoré (Guinea). We reported a high prevalence of HIV and HBsAg, with a predominance of men, a high representation of people from urban areas, generally farmers and with blood group O for both diseases. Almost all of the donors had never given blood. Sex, serological status and history of blood donation were factors associated with HIV positivity. For HBsAg, HIV serostatus and blood donation history were factors associated with seropositivity. Strict pre-donation screening of all donors could be a solution to ensure a good supply of quality blood for transfusion safety.

Acknowledgements

The authors would like to thank the technical staff. We would also like to thank all the participants in this study.

Authors' Contributions

All the authors have contributed to the design, translation or layout of this paper, albeit to different degrees. Contributed to conception and data collection: AC, ET, INH, YY, ISD, MSD, KK and AT. Contributed to study design: AC, ET, INH, KK and AT. Contributed to data analysis: ET, INH, AT, YY, AC, JC and MC. Wrote the paper: ET, AC, INH, DK, KK, TMT, BM and SB. Correction and formatting: AC, AT, KK, MSD, BM and SB.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Agence de la santé publique Canada (2002) Incidents Transfusionnels (IT). https://www.canada.ca/fr/sante-publique/services/surveillance/programme-contributions-surete-sang/section-incidents-transfusionnels/risques.html

[2] Kakisingi, C.N., Mukuku, O., Matanda, S.K., Manika, M.M., Kyabu, V.K., Kasamba, E.I., *et al.* (2016) Profil épidémiologique et séroprévalence des donneurs de sang aux cliniques universitaires de Lubumbashi, République Démocratique du Congo. *Pan African Medical Journal*, **23**, Article 175. https://doi.org/10.11604/pamj.2016.23.175.8480

[3] OMS (2023) Sécurité transfusionnelle et approvisionnement en sang. https://www.who.int/fr/news-room/fact-sheets/detail/blood-safety-and-availability

[4] Fohoue, A.M., Sack, F.N., Fossi, C.T., Fossi, A. and Bassong, Y.O.M. (2019) Préva-

lence des Infections Transmissibles par Transfusion Sanguine chez les Donneurs de Sang à l'Hôpital Central de Yaoundé—Cameroun. *Health Sciences and Diseases*, **20**, 23-28.

[5] Sarr, H., Mayaki, Z., Dardenne, N., Kabo, R., Moutschen, M., Sondag, D., Albert, A., Gérard, C., *et al*. (2021) Séroprévalence des Marqueursd'AgentsInfectieux (VIH, VHB, VHC et Syphilis) chez les Donneurs de Sang à Ziguinchor. *Health Sciences and Diseases*, **22**, 81-84.

[6] Cissé, M. (2020) La Séroprévalence des marqueursbiologiques chez les donneurs de sang de Janvier à Décembre 2018 au Centre HospitalierUniversitaire de Gabriel Toure. Master's Thesis, Université des Sciences, des Techniques et des Technologies de Bamako.

[7] Loua, A., M.L. Sow, E., Magassouba, F.B., Camara, M. and Baldé, M.A. (2004) Évaluation du risque infectieux résiduel chez les donneurs de sang au Centre national de transfusion sanguine de Conakry. *Transfusion Clinique et Biologique*, **11**, 98-100. https://doi.org/10.1016/j.tracli.2004.01.004

[8] Comité National de LutteContre le, Sida (2012) Rapport annuel de la Riposte Nationale aux IST/VIH/SidaGuinée.

[9] Packo, D.S.S., Tomlbaye, F.O., Conde, A., Diakité, M., Kouandogui, F. and Camengo-Police, S.M. (2022) CaractéristiquesÉpidémiologiques et Cliniques des Donneurs de Sang Co-Infectés par les Virus VIH et VHB au Centre National de Transfusion Sanguine de Bangui. *Health Sciences and Diseases*, **23**, 46-48.

[10] Chigurupati, P. and Murthy, K.S. (2015) Automated Nucleic Acid Amplification Testing in Blood Banks: An Additional Layer of Blood Safety. *Asian Journal of Transfusion Science*, **9**, 9-11. https://doi.org/10.4103/0973-6247.150938

[11] Mbanya, D. (2013) Use of Quality Rapid Diagnostic Testing for Safe Blood Transfusion in Resource-Limited Settings. *Clinical Microbiology and Infection*, **19**, 416-421. https://doi.org/10.1111/1469-0691.12184

[12] Robertson, C., Archibald, D., *et al*. (2014) Systematic Reviews and Integrated Report on the Quantitative, Qualitative and Economic Evidence Base for the Management of Obesity in Men. *Health Technol Assess*, **18**, 458p. https://doi.org/10.3310/hta18350

[13] Goita, D., Traore, M., Kassogue, O., Sogoba, D., Guindo, S., Keita, B.S., *et al*. (2019) Séroprévalence du VIH, des Virus des Hépatites B et C et de la Syphilis chez les Donneurs de Sang à l'Hôpital de Sikasso, Mali. *Health Sciences and Diseases*, **20**, 43-46.

[14] Koné, M.C., Sidibé, E.T., Mallé, K.K., Beye, S.A., Lurton, G., Dao, S., *et al*. (2012) Seroprevalence of Human Immunodeficiency Virus, Hepatitis B Virus and Hepatitis C Virus among Blood Donors in Segou, Mali. *Médecine et Santé Tropicales*, **22**, 97-98. https://doi.org/10.1684/mst.2012.0016

[15] Diarra, A.B., Guitteye, H., Fomba, M., Cisse, M., Traore, D., Traore, A., *et al*. (2019) Viral Hepatitis B and C in Blood Donors of the National Blood Transfusion Center Bamako, Mali. *Revue Malienne d'Infectiologie et de Microbiologie*, **14**, 58-61.

[16] Katilé, D., Konaté, I., Goita, D., Kaboré, M., Dicko, M.Y., Mallé, O., Kondé, A., *et al*. (2018) Prévalence de l'Antigène HBs et ProfilSérologique du Virus de l'Hépatite B en Consultation de Médecine Générale à l'HôpitalRégional de Kayes au Mali 2018. *Health Sciences and Diseases*, **19**, 16-19.

[17] Mudji, J., Malala, J. and Horsmans, Y. (2021) Seroprevalence of Viral Hepatitis B and C in Two Populations: Blood Donors and Patients with Suspected Hepatic Cirrhosis in Kwilu Province, Democratic Republic of Congo. *International Journal of Infectious Diseases*, **110**, 222-225.

[18] Barry, M., Diallo, M.G., Diallo, S., Boiro, M.Y., Soumah, L., *et al*. (2023) Circulation du virus de l'hépatite B chez les donneurs de sang dans la Région de Mamou—République de Guinée. *International Journal of Biological and Chemical Sciences*, **17**, 1180-1184.

[19] Tonda, J., Mickala, P., Mombo, L., Mengue, J.E., Mongo-Délis, A., Mbacky, K., *et al*. (2017) Séroprévalence du virus de l'immunodéficience humaine, des virus des hépatites B et C et de *Treponema pallidum* chez les donneurs de sang dans une zone rurale au sud-est Gabon (Koula-Moutou). *Journal of Applied Biosciences*, **110**, 10783-10789. https://doi.org/10.4314/jab.v110i1.8.

[20] Samje, M., Sop, S., Tayou, C.T. and Mbanya, D. (2021) Knowledge, Attitude and Seropositivity of Hepatitis B Virus among Blood Donors in the Bamenda Regional Hospital Blood Bank, Cameroon. *Pan African Medical Journal*, **39**, Article 33. https://doi.org/10.11604/pamj.2021.39.33.28911

[21] Ankouane, F., *et al*. (2016) Séroprévalence des virus des hépatites B et C, du VIH-1/2 et de la syphilis chez les donneurs de sang de l'hôpital central de Yaoundé, région du centre, Cameroun. EM-Consulten. https://www.em-consulte.com/article/1062281/seroprevalence-des-virus-des-hepatitesb-et-c-du-v

[22] Nouanthong, P., Hefele, L., Keokhamphue, J., Sorrasin, V., Khounvisith, V., Souksakhone, C., *et al*. (2021) Analyses of Blood Donor Samples from Eight Provinces in Lao PDR Suggest Considerable Variation Concerning HBV Exposure and Carriage. *PLOS ONE*, **16**, e0259814. https://doi.org/10.1371/journal.pone.0259814

[23] Institut National des Statistiques (INS) (2018) Enquete Demographique et de Santé (EDS V). https://www.unicef.org/guinea/media/2106/file/EDS%202018.pdf

[24] Ahmed, R., Fatima, M., Ashfaq, J., Tariq, S.F., Naseer, I., Asif, M., *et al*. (2022) Frequency of Hepatitis B, C, and Human Immunodeficiency Virus in Blood Donors. *Cureus*, **14**, e25978. https://doi.org/10.7759/cureus.25978

[25] Keita, M., Fadiga, A.G., Soumah, M.M., Sylla, D., Traore, F.A., Biané, B., *et al*. (2014) Co-infection VIH et virus de l'hépatite B au service d'hématologie de l'hôpital national Ignace Deen (Guinée-Conakry). *Annales de Dermatologie et de Vénéréologie*, **141**, S442. https://doi.org/10.1016/j.annder.2014.09.479

[26] Bartonjo, G., Oundo, J. and Ng'ang'a, Z. (2019) Prevalence and Associated Risk Factors of Transfusion Transmissible Infections among Blood Donors at Regional Blood Transfusion Center Nakuru and Tenwek Mission Hospital, Kenya. *Pan African Medical Journal*, **34**, Article 31. https://doi.org/10.11604/pamj.2019.34.31.17885

[27] Tognon, F., Sevalie, S., Gassimu, J., Sesay, J., Hann, K., Sheku, M., *et al*. (2020) Seroprevalence of Hepatitis B and Hepatitis C among Blood Donors in Sierra Leone: A Multi-Year Retrospective Study. *International Journal of Infectious Diseases*, **99**, 102-107. https://doi.org/10.1016/j.ijid.2020.07.030

[28] Ouedraogo, H.G., Kouanda, S., Grosso, A., Compaoré, R., Camara, M., Dabire, C., *et al*. (2018) Hepatitis B, C, and D Virus and Human T-Cell Leukemia Virus Types 1 and 2 Infections and Correlates among Men Who Have Sex with Men in Ouagadougou, Burkina Faso. *Virology Journal*, **15**, Article No. 194. https://doi.org/10.1186/s12985-018-1110-8